REMARKS

Claims 26-43, 46-55, 97 and 99 are pending in the application, with claims 26, 27, 29-34, 46-51, 97 and 99 being currently amended, and previously pending claims 98 and 100 being cancelled.

Also, as a part of this reply, Applicant has included the declaration of William J. van Ooij ("van Ooij Declaration") pursuant to 37 C.F.R. §1.132. The van Ooij Declaration is attached as Exhibit A.

Independent claim 26 has been further amended to recite a method of bonding rubber to a metal substrate which includes, in part, applying a silane solution comprising a substantially hydrolyzed bis amino-silane and a substantially hydrolyzed bis sulfur-containing silane to at least a portion of a surface of the metal substrate [underlining for emphasis]. Claim 26 also now further recites, in part, applying an uncured, sulfur curable rubber onto the surface of the metal substrate having a coating thereon and sulfur curing the rubber to bond the rubber to the coated metal substrate [underlining for emphasis]. Independent claim 46 is similarly amended. Support for the amendments can be found throughout the application and at least at paragraphs [0011], [0012], [0028]-[0030], and the Examples, for example.

Currently amended dependent claims 27, 29-34, and 97 have been amended to properly depend, directly or indirectly, from independent claim 26 whereas claims 47-51and 99 have been amended to properly depend, directly or indirectly, from independent claim 46. In particular, those dependent claims now more clearly recite to the bis amino silane, the bis sulfur silane, and/or the sulfur curable rubber. With specific reference to dependent claims 29 and 47,

those dependent claims now more clearly recite a formula 1 that defines bis amino-silanes. Support for the amendments can be found throughout the application and at least at paragraphs [0028] and [0029], for example.

In the Official Action, Examiner continues to maintain his rejection of previously pending claims 26-35, 41-43, 97, and 98 under 35 U.S.C. §103(a) as being unpatentable over the combination of Van Ooij WO 00/63462 ("the '462 application"), Van Ooij U.S. Patent No. 6,416,869 ("the '869 patent"), or Van Ooij U.S. Patent No. 6,756,079 ("the '079 patent")[1] in view of Pines U.S. Patent No. 3,088,847 ("Pines"). The Examiner further continues to maintain his rejection of previously pending claims 36-40, 46-55, 99, and 100 over the '462 application, the '869 patent, or the '079 patent in view of Pines and further in view of Shimakura U.S. Patent No. 6,475,300, ("Shimakura"). In addition, previously pending claims 26-35, 41-43, 97, and 98 stand rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the combined limitations of claims 7-19, 24-31, and 33 of the '079 patent in view of Pines. Whereas, claims 36-40, 46-55, 99, and 100 stand rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the combined limitations of claims 7-19, 24-31, and 33 of the '079 patent in view of Pines and further in view of Shimakura.

[1] Applicants continue to submit that the separate §103 rejections based on the three different Van Ooij references are duplicative and, thus, create a needless and improper burden on Applicant by having to respond to each of those rejections. Surely, Examiner is aware that in selecting the references to be cited, he is not called upon to cite *all* references that may be available, but only the "best." Indeed, "multiplying references, any one of which is as good as, but no better than, the others, adds to the burden and cost of prosecution and should therefore be avoided." MPEP §904.0.3. As such, Applicants kindly request Examiner to avoid the improper multiplication of references in his rejections.

Examiner also continues to recognize in the Official Action that the '462 application, the '869 patent, and the '079 patent fail to explicitly disclose a coating thickness in the range from about 0.1 μm to about 1 μm, as required by independent claims 26 and 46, and from about 0.2 μm to about 0.6 μm, as required by dependent claims 42 and 55. However, to support his non-obviousness rejection, Examiner continues to rely on Pines to fill the teaching void of those references. In reliance thereon, Examiner states that Pines discloses a "similar method, wherein aminoalkyl-alkoxy silanes are applied to a metal substrate as a primer layer" with a polymeric material, including rubber, applied on top of that primer layer. The coating thicknesses of the primer layer disclosed in Pine is alleged by Examiner to overlap with both of the instantly claimed ranges, i.e., from about 0.1 μm to about 1 μm (and from about 0.2 μm to about 0.6 μm). In view thereof, Examiner asserts that it would have been obvious to one of ordinary skill in the art to use a coating thickness of from about 0.1 μm to about 1 μm or from about 0.2 μm to about 0.6 μm, as allegedly taught by Pines, in the method of the Van Ooij references, because Pines discloses a similar method of using an aminoalkyl-alkoxy silanes to bond rubber to metal, wherein film thicknesses ranging from 0.01 to 0.10 mil (0.254 μm – 2.54 μm) are preferred. *See* Official Action, Pages 5-6, for example. Applicants respectfully disagree and submit that Examiner is just plain wrong, particularly in light of the claims as now amended.

Independent claim 26 now calls for a silane solution that includes a bis amino-silane and a bis sulfur-containing silane. In addition, the claim now calls for sulfur curing a sulfur curable rubber to bond the rubber to a metal substrate coated with a coating thickness of from about 0.1 μm to about 1 μm of that silane solution.

Surely, Examiner is aware that a *prima facie* showing of obviousness is satisfied if there is an apparent reason to combine the prior art references flowing from either the references, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved, and the results are expected. *KSR Int'l. Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1740 (2007); *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). In the instant case, Examiner has failed to establish a *prima facie* case of obviousness for the reasons that follow. And, in an effort to help Examiner understand the errors in his rejections, Applicants have provided and reference throughout this response the Declaration of Wim J. van Ooij, an expert in silane chemistry technologies, particularly metal to rubber bonding using silane solutions.

In comparison to the Van Ooij references, as well as the presently claimed invention, and in stark contrast to Examiner's assertion, Pines does not at all disclose a similar method for bonding rubbers to metals. In other words, Applicants submit that there is nothing in Pines that would lead one skilled in the art to combine it with any of the Van Ooij references to provide a bis amino/bis sulfur silane coating thickness of from about 0.1 μm to about 1 μm on a metal substrate then sulfur curing rubber thereto, as now required by independent claim 26 (and 46).

In particular, Pines specifically discloses silicone rubber (a saturated polymer) and neoprene, a diene rubber, for example, which are peroxide-cured rubbers, not sulfur-cured rubbers. *See* Examples. In addition, the silane solution taught by Pines involves an amino silane (or copolymers thereof) and, optionally, a vinyl silane. *See, e.g.*, col. 2, line 23 to col. 5, line 44, and Table 1. Such silanes are understood to be ineffective for bonding sulfured cured rubber to

metal. Indeed, as stated by the Declarant,Wim J. van Ooij, an expert in bonding rubber to metal using silane coatings, "these silanes have been found by me to be inactive to rubbers of the diene type when cured by sulfur (and sulfenamide accelerators)." In addition and in contrast to Pines' silanes, the claimed silane system and that of the Van Ooij references include two specific bis silanes, preferably in a certain ratio. One of the silanes must contain sulfur and the other a secondary amino group. This bis-sulfur and bis-amino silane mixture is quite different from that of Pines' amino silane, or the amino silane and vinyl silane mixture. As best explained by the Declarant Wim J. van Ooij:

> This silane mixture of bis-sulfur and bis-amino silane is quite different from that of Pines and the only silane process, thus far, that we have found to bond to sulfur-cured rubbers. In fact, we have tested dozens of other silanes before we discovered the bis-sulfur/bis-amino mixture, but the results were all negative, i.e., no or very poor bond strength was obtained. So, this mixture and coating method are unique and quite different from Pines. *See* Van Ooij Declaration, Paragraph 9.

Clearly, at the outset, due to these differences alone, one having ordinary skill in the art is hard pressed to find any rationale to combine the coating thickness of Pines with the silane mixtures of the Van Ooij references. Even so, to further help Examiner understand the error in his argument and why there is nothing in Pines that would lead one skilled in the art to combine it with any of the Van Ooij references, Applicants also explain that the silanes of Pines are only mono-silanes whereas the silanes that are used in the Van Ooij references and the present application are bis-silanes. And, those mono-silanes are ineffective for bonding sulfur cured rubber to metal. To that end, the Declarant explains as follows:

> I have tested the mono versions of the two silanes, viz., γ-aminopropyl triethoxy silane and mercapto trimethoxy silane, but the results were negative. No adhesion to speak of was obtained. Thus, there is not only the need for a specific mixture of silanes, i.e. amino and sulfur silanes, for bonding metals to sulfur-vulcanized rubber, there is also the requirement that the silanes be of the bis-silane type. *See* Van Ooij Declaration, Paragraph 10.

Finally, in terms of mechanisms of bonding, there are also substantial and fundamental differences between Pines and that of both the Van Ooij references and the present invention. These differences in the mechanisms of bonding help explain why the coating thickness in Pines is not at all critical or relevant to Applicant's method of bonding sulfur curable rubber which uses a bis amino/bis sulfur silane solution. As explained by the Declarant Wim J. van Ooij:

> The bond formation in Pines relies on the oxidation of the silane film by the peroxide in the rubber. The oxidation leads to the formation of covalent C-C bonds between the surface of the silane film, a primer, and the rubber coating. This explains why the thickness of the silane film in Pines is not at all critical, as only the surface of the silane film contributes to the bond strength. It further explains why Pines uses a vinyl silane as a second silane, rather than a sulfur silane, for example. The vinyl group (-C=C-) is very easily oxidized by peroxides. The choice of the γ-aminopropyltriethoxy silanes by Pines is also understandable, as the R group in –N-R-Si≡ is also easily oxidized by peroxides. The primary amine group ($-NH_2$) plays no direct role in the bond formation but it makes the –R group ($-CH_2CH_2CH_2-$) more sensitive to oxidation by peroxides. *See* Van Ooij Declaration, Paragraph 11.

Surely, the lack of rationale to combine the coating thickness of Pine with the silane solutions of the Van Ooij references is readily apparent when still further specifically compared to the bonding mechanisms of the rubber-silane-metal system of the present

application and the Van Ooij references. As explained by the Declarant:

> In the rubber-silane-metal system of the present application, the sulfur silane is essential, as during the cure it will decompose into Si-R-S• radicals which are reactive towards the –C=C-C- groups in the rubber. The monosilanes containing sulfur do not form such radicals so therefore they do not bond to rubber. The bis-amino silane in our mixture is required, as the secondary amino groups $-NH_2-$ have a catalytic activity for crosslinking ethylsilyl groups in the absence of water, i.e., without hydrolysis.
>
> $$\equiv Si\text{-}OC_2H_5 + H_5C_2O\text{-}Si\equiv \xrightarrow{-NH-} \equiv Si\text{-}O\text{-}Si\equiv + H_5C_2OC_2H_5$$
>
> This explains why we need the bis-amino silane, as the monoamino silanes, e.g., the type used in the Pines patent, has a primary amino group which has considerable lower catalytic activity. *See* Van Ooij Declaration, Paragraph 12.

In view of all of the above and the teachings in Pines, Applicants submit that it must be abundantly clear to one skilled in the art that Pines does not at all disclose a similar method for bonding rubbers to metals like that discussed in the Van Ooij references or the present invention. In other words, there is nothing in Pines that would lead one skilled in the art to combine it with any of the Van Ooij references. As best stated by the Declarant, an expert in the industry, "[t]he clearly different silane composition of Pines, and its non-critical coating thickness, provide no rationale basis to form a coating thickness of from about 0.1 μm to about 1 μm using the bis amino/bis sulfur silanes of the Van Ooij references." *See* Van Ooij Declaration, Paragraph 13. And, further to that end, as explained by the Declarant:

> [I]t may be concluded that the use of a specific coating thickness, which coating includes two bis-silanes, i.e., bis-sulfur and bis-amino, for bonding metals to sulfur-cured rubber, as required by claims 26 and 46, is by no means obvious and cannot be predicted from the combination of the Pines patent and the Van Ooij references, not even by someone skilled in the art. Simply stated,

the Pines coating thickness is not at all applicable to Applicants' method. *See* Van Ooij Declaration, Paragraph 14.

In addition, because Pines fails to provide the requisite teachings to maintain Examiner's 103 obviousness rejections, the additional rejections based further on the combination of Shimakura must also fall. Regardless, Applicants submit that Shimakura simply fails to provide any discussion of bonding rubber to metal, as is required by independent claims 26 and 46. Rather, Shimakura concerns itself with bonding top coats, i.e. paint (NOT rubber), to metal substrates such as via a nonchromate primer coating (not a silane solution). *See, e.g.,* abstract; col. 2, lines 46-67; col. 5, lines 51-58; col. 6, lines 5-14 and 39-46, and the Examples. In contrast, Applicants' method specifically requires bonding rubber to metal. Because Shimakura teaches non-rubber to metal bonding, what motivation or suggestion is there to combine the teachings of this reference with the rubber bonding of the '462 application, the '869 patent, or the '079 patent and Pines to provide Applicants' claimed methods of bonding rubber to metal? There is none.

Accordingly, in view of the above, it is respectfully submitted that the rejections of independent claims 26 and 46 as obvious are in error and should be withdrawn. In addition, the rejection of dependant claims 27-43, 47-55, and 97-100 are also in error and should be withdrawn.

Finally, as stated above, Examiner now maintains rejection of all pending claims based on non-statutory obviousness-type double patenting. In particular, claims 26-35, 41-43, 97, and 98 are rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the combined limitations of claims 7-19, 24-31, and 33 of the '079

patent in view of Pines. Whereas, claims 36-40, 46-55, 99, and 100 are rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the combined limitations of claims 7-19, 24-31, and 33 of the '079 patent in view of Pines and further in view of Shimakura.

A double patenting rejection of the obviousness-type, if not based on an anticipation rationale, is "analogous to [a failure to meet] the nonobviousness requirement of 35 U.S.C. 103" except that the patent principally underlying the double patenting rejection is not considered prior art. *In re Braithwaite*, 379 F.2d 594, 154 USPQ 29 (CCPA 1967). Therefore, the analysis employed in an obviousness-type double patenting rejection parallels the guidelines for analysis of a 35 U.S.C. 103 obviousness determination. *In re Braat*, 937 F.2d 589, 19 USPQ2d 1289 (Fed. Cir. 1991); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985). As can be plainly seen from a reading of the Official Action, Examiner has generally regurgitated the obviousness arguments based on the '079 patent in view of Pines and also further in view of Shimakura and relabeled them as obviousness-type double patenting rejections. These relabeled rejections are equally as flawed as Examiner's obviousness rejections for the reasons stated above. Thus, it is submitted that Applicant's methods are not an obvious variation of any of claims 7-19, 24-31, and 33 of the '079 patent in view of Pines and further in view of Shimakura. Accordingly, Applicants respectfully submit that the rejections based on non-statutory obviousness-type double patenting are in error and must be withdrawn.

Conclusion

As a result of the remarks given herein, Applicants submit that the rejections of the pending claims have been overcome. Therefore, Applicant respectfully submits that this case is in condition for allowance and requests allowance of the pending claims.

If this Response leaves any issues open or the Examiner wishes to discuss any further issues, a call to undersigned counsel would be gratefully appreciated. Applicants also have submitted all fees believed to be necessary herewith. Should any additional fees or surcharges be deemed necessary, the Examiner has authorization to charge fees or credit any overpayment to Deposit Account No. 23-3000.

Respectfully submitted,
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